[6450-01

DEPARTMENT OF ENERGY

Request for Information (RFI) Regarding Planning for Establishment of a Program to Support the Availability of High-Assay Low-Enriched Uranium (HALEU) for Civilian Domestic Research, Development, Demonstration, and Commercial Use

AGENCY: Office of Nuclear Energy, Department of Energy.

ACTION: Request for information.

SUMMARY: The U.S Department of Energy (DOE or the Department) is issuing this RFI to invite input on the planning for establishment of a DOE HALEU Availability Program and to gather information to consider in preparing the required report to Congress describing actions proposed to be carried out by DOE under the program. The Energy Act of 2020 authorized the Department to establish and carry out, through the Office of Nuclear Energy, a program to support the availability of high-assay low-enriched uranium (HALEU) for civilian domestic research, development, demonstration, and commercial use.

DATES: Written comments and information are requested on or before [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN *FEDERAL REGISTER***].

ADDRESSES: Interested persons may submit comments by any of the following methods:

1. *Email*: *rfi-haleu@hq.doe.gov*. Submit electronic comments in Microsoft Word or PDF file format and avoid the use of special characters or any form of encryption. Please include "Response to RFI" in the subject line.
2. *Postal Mail*: This option is not available.
3. *Hand Delivery/Courier*: This option is not available during the COVID-19 pandemic.
4. *Online*: Responses will be accepted online at *www.regulations.gov*.

Instructions: All submissions received must include the agency name for this RFI. No facsimiles (faxes) will be accepted. Any information that may be business proprietary and exempt by law from public disclosure should be submitted as described in Section IV of this document.

FOR FURTHER INFORMATION CONTACT: Requests for additional information should be sent to: *rfi-haleu@hq.doe.gov* or Dr. Daniel Vega, *daniel.vega@nuclear.energy.gov*, (202) 586-0235, or Michael Reim, *michael.reim@nuclear.energy.gov*, (202) 586-0509.

Please include "Question on HALEU RFI" in the subject line.

SUPPLEMENTARY INFORMATION:

I. Background

The Department is working to enable the development and deployment of advanced nuclear reactors as part of meeting the Administration's job creation, energy security and climate goals. DOE's Advanced Reactor Demonstration Program was established to partner with domestic private industry to help accelerate the development and demonstration of advanced nuclear reactors in the United States. Most advanced reactors, including several designs selected for the Advanced Reactor Demonstration Program, are designed to be fueled by HALEU. The Secretary of Energy was authorized in Sec. 2001 of the Energy Act of 2020 to establish and carry out, through the Office of Nuclear Energy, a program to support the availability of HALEU for civilian domestic research, development, demonstration, and commercial use (HALEU Availability Program). A HALEU Availability Program, leading to the deployment and commercialization of clean energy technologies and infrastructure, could secure a critical domestic supply chain for meeting the Administration's climate, economic, and energy security goals. This program would include substantive engagement by stakeholders, including State, local, and Tribal governments. The program would prioritize addressing

long-standing and persistent energy justice issues and be responsive to President Biden's Justice40 Initiative[1] by targeting 40 percent of the benefits of climate and clean infrastructure investments to disadvantaged communities, considering rural communities and communities impacted by the market-based transition to clean energy, and include substantive stakeholder engagement.

Currently, there is very limited domestic capacity to provide HALEU from either DOE or commercial sources. This lack of capacity is a significant obstacle to the development and deployment of advanced reactors for commercial applications.

Specifically, DOE's National Nuclear Security Administration (NNSA) provides highly enriched uranium (HEU), HALEU, and Low Enriched Uranium for its defense and nonproliferation missions. Most of NNSA's HEU is reserved for the Naval Reactors program and for use in the nuclear weapons stockpile, and is therefore unavailable for down-blending to use in advanced reactors used for commercial applications. Other HEU in the inventory is allocated to supply research reactors and medical isotope production facilities worldwide, and to meet critical defense and space requirements. After accounting for these requirements on the inventory, the remaining amount of HEU to be down-blended to HALEU for advanced commercial reactors is very limited. If these supplies were redirected to fuel advanced commercial reactors, they would not be sufficient to meet the projected near-term demands for advanced reactor demonstration and deployment. Furthermore, diverting these resources to support advanced reactor demonstration and deployment would compromise vital nuclear security and nonproliferation missions.

Likewise, on the commercial side, there is no domestic assured source of HALEU to be used to produce fuel for advanced reactors in sufficient quantities to meet

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[1] *https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/*

anticipated demand. In turn, uncertainty regarding the commercial deployment of advanced reactors and future demand for HALEU undermines private investment to develop an assured HALEU supply capability and related infrastructure.

The HALEU Availability Program envisioned in the Energy Act of 2020 is intended to address this problem by temporarily securing a supply of HALEU to support research, development, demonstration, and equitable deployment of advanced reactors for commercial applications. This action, in turn, could spur demand for additional HALEU production and private investment in nuclear fuel supply infrastructure and ultimately remove the government from any role as a supplier of HALEU for industry. The development of a viable domestic commercial supply of HALEU for advanced commercial power reactors could also supply the needs of medical isotope producers and civilian research reactors. The program outlined in Sec. 2001 of the Energy Act of 2020 would sunset on September 30th, 2034, or 90 days after adequate supply is established.

II. Specific Questions on Which Information Is Requested

Public input is requested on information the Department should consider as it plans a program to support HALEU availability for civilian domestic research, development, demonstration, and commercial use. The information gathered in response to this RFI will be considered by DOE in planning for the HALEU Availability Program and other relevant planning and reporting purposes as needed. In providing information in response to this RFI, please include the data, analysis, and/or other justification for the responses, where applicable. Please note that any information that may be business proprietary and exempt by law from public disclosure should be submitted as described in Section IV of this document.

To facilitate public input, this RFI includes a set of specific questions on which the Department would appreciate input. These questions are listed below.

Establishment of a HALEU Consortium & Market Development

(1) Sec. 2001 of the Energy Act of 2020 directs the establishment and periodic updating of a HALEU Consortium to partner with DOE to support the availability of HALEU for civilian domestic demonstration and commercial use. Among other things, the Act envisions that the HALEU Consortium could: provide information to DOE for purposes of biennial surveys on the quantity of HALEU needed for commercial use for each of the subsequent five years; purchase HALEU made available by the Secretary for commercial use by members of the consortium; and carry out demonstration projects using HALEU provided by the Secretary under the program.

What types of organizations or other entities should be included in the HALEU Consortium? If your organization or entity might be interested in becoming a member of a HALEU Consortium, please describe the contribution your organization or entity could provide to the consortium. The description should include examples of the type of activity or activities for which your organization or entity is interested in partnering with the Department. Please also provide a point of contact for your organization or entity, including name, affiliation, email, and phone number.

(2) Please identify any issues, including energy justice concerns, that may affect the implementation of the HALEU Availability Program under Sec. 2001 of the Energy Act of 2020, in an equitable manner that would further the development and deployment of advanced reactors and the establishment of a domestic commercial source of HALEU.

(3) What are the most significant barriers to the establishment of a reliable market-driven, commercial supply of HALEU for advanced reactor research, demonstration, and commercial deployment? Please describe these barriers in detail, identify potential actions to address these barriers, and include the timeframes in which the issues should be addressed.

(4) If the Department were to address the objectives of *Sec. 2001 of the Energy Act of 2020* related to the creation of a fuel bank to supply HALEU for civilian domestic research, development, demonstration, and commercial use:

- What is the quantity (in metric tons/assay) of HALEU necessary for domestic commercial use for each of the next five years (2022 – 2026)?

- If a "stockpile" of HALEU were established to build confidence in the supply of HALEU supporting early orders for the deployment of advanced reactors in the commercial market, how large (in metric tons/assay) a stockpile would be needed?
- What siting and energy justice issues should the Department take into account as it considers the development of a program and how might the Department address those issues?

(5) Please identify any additional specific actions that would provide confidence in the short-term supply of HALEU and thereby to ensure the development of a commercial market for advanced reactor orders.

- What actions might be most useful for the U.S. Government to carry out?
- What actions might be most appropriate for the private sector to carry out?

(6) What level of market demand for HALEU over what timeframe is needed to stimulate investment in the infrastructure required to support a HALEU supply chain?

(7) On what basis should HALEU be priced or valued? Please consider the options for the pricing of HALEU based on enrichment, weight, and/or separative work units and provide the pros and cons for each option or combination of options. Please discuss how pricing options would provide DOE with reasonable compensation and commercial entities with sufficient incentive to deploy domestic capacity to supply

HALEU. What is your long-term estimated "price point" for the range of assays/enrichment (2030 and beyond)? Please consider and note the form of HALEU (e.g., metal, oxide, UF_6, etc.) in your response.

HALEU Supply Chain Development

(8) Advanced reactors under development (including awardees under the Advanced Reactor Demonstration Program) would utilize HALEU in various chemical and physical fuel forms, including oxides, metals, and potentially salts. Additionally, centrifuge enrichment requires uranium in hexafluoride form. What additional fuel cycle infrastructure, or additions or modifications to existing infrastructure, would enable the deployment of commercial HALEU production and assure the availability of different forms of HALEU in sufficient quantities for use in advanced reactors?

(9) How do you envision a HALEU supply chain as being responsive to the President's Justice40 Initiative — a plan to deliver 40 percent of the overall benefits of climate investments to disadvantaged communities and inform equitable research, development, and deployment within DOE? Please provide specific actions and the type of benefits (e.g., employment, educational opportunities, etc.) that could be most useful to the targeted communities in response to the Justice40 Initiative.

(10) What are some approaches or contracting vehicles that could be used by the Department to help enable the necessary commercial deployment of a domestic HALEU supply chain, including but not limited to mining, conversion, enrichment, deconversion, transportation, and fuel fabrication? For each, please discuss potential federal versus private sector actions; in addition, discuss leveraging robust partnerships for co-development of sub-elements of the supply chain.

Possible approaches that might be considered include:

- Production contracts (of what volume and length);

- Take-or-pay contracts (U.S. Government agrees to take specified volume of goods and/or services for a specified time period);
- Partnerships and/or cost-sharing of infrastructure development, including with allies and partners; and
- Payment-for-production milestones.

(11) What specific technological, regulatory, and/or legal gaps or challenges currently exist for transporting HALEU in various chemical forms (e.g., oxide, hexafluoride, metal) throughout the HALEU fuel supply chain? How do these challenges change depending upon the enrichment level? What actions could be taken, when, and by whom, to address the identified gaps or challenges?

(12) Questions specific for transportation packaging companies:

(i) What actions, either federal or non-federal, might help incentivize the development and delivery of a new or modified 30-inch cylinder? Please discuss incentive amounts and incentive areas (design, licensing, certification, overpack re-certification, etc.) as appropriate that would be most helpful to accelerate the delivery date.

(ii) If your company were to receive an order for a 30-inch transportation package that is certified by NRC to contain enriched uranium hexafluoride up to 19.75 wt. percent Uranium-235, what do you expect would be the earliest delivery date possible? What do you anticipate would be its maximum loading?

(13) Co-location of facilities for the front end of the fuel cycle (such as enrichment, and conversion/deconversion, and fabrication) may be a practicable solution to address some HALEU transportation issues. Is co-location considered otherwise beneficial? Are there other solutions that should be considered?

(14) What factors affect the ability of U.S. uranium producers to provide uranium for advanced reactor fuel? Please indicate the importance of such factors and how they may be addressed.

Regulatory Issues

(15) What are the technical barriers and/or regulatory requirements (e.g., safety, security, material control and accountability) to licensing front-end fuel cycle facilities (e.g., enrichment, deconversion, and/or fuel fabrication facilities) for the production and availability of HALEU?

- For existing facilities to upgrade to a HALEU capability?
- For new facilities?

(16) What, if any, additional criticality and/or benchmark data is needed to meet U.S. Nuclear Regulatory Commission (NRC) safety and regulatory requirements that must be met in order to establish a supply chain capable of making HALEU available for the development and deployment of advanced reactors? Please consider and address both front-end fuel cycle facilities and transportation packages (including for metal, gas, and pertinent chemical forms).

(17) What, if any, additional challenges or considerations may be associated with a HALEU lifecycle (including disposition), beyond those of a traditional light water reactor fuel cycle, and how can they be can be identified early and addressed?

(18) What other legal, funding, and other issues should be addressed to best enable the development of a HALEU availability program and promote private sector deployment of domestic HALEU production capacity?

Financial Barriers

(19) Please describe the financial challenges associated with developing a sustainable commercial fuel supply chain for HALEU. Specifically, what are the challenges

related to the acquisition of funds for investment in HALEU production infrastructure? How might these challenges be mitigated?

Human Resources

(20) What are the human resource-related considerations related to the buildout of commercial HALEU production?

- Are there specific recruitment and/or training challenges that must be overcome?
- What types of skillsets are needed to develop and deploy the domestic commercial production of HALEU? Would this increase the number of union jobs?
- Please describe the nature of any anticipated shortage in subject matter expertise and its potential impact.

Other

(21) Are there additional considerations or recommendations, including the timing of various actions, that should be considered with respect to key challenges to HALEU availability for civilian domestic research, development, demonstration, and commercial use in the United States?

III. Submission of Comments

DOE invites all interested parties to submit, in writing by **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**, comments and information on matters addressed in this RFI. Any information that may be business proprietary and exempt by law from public disclosure should be submitted as described in Section IV of this document.

IV. Business Proprietary Information

Pursuant to 10 CFR 1004.11, any person submitting information they believe to be business proprietary and exempt by law from public disclosure should submit via

email two well-marked copies: One copy of the document marked "Business Proprietary" including all the information believed to be proprietary, and one copy of the document marked "Non-Proprietary" deleting all of the information believed to be business proprietary. DOE will make its own determination about the business proprietary status of the information and treat it according to its determination. Factors of interest to DOE when evaluating requests to treat submitted information as business proprietary include: (1) a description of the items; (2) whether and why such items are customarily treated as business proprietary within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its business proprietary nature; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when such information might lose its business proprietary character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

Signing Authority

This document of the Department of Energy was signed on December 8, 2021, by Andrew Griffith, Deputy Assistant Secretary for Nuclear Fuel Cycle and Supply Chain, Office of Nuclear Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on December 9, 2021.

Treena V. Garrett,
Federal Register Liaison Officer,
U.S. Department of Energy.

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